LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **CHEMISTRY**

THIRD SEMESTER – **NOVEMBER 2024**

PCH3MC01 – MAIN GROUP ELEMENTS AND NUCLEAR CHEMISTRY

Date: 07-11-2024 Dept. No. Max. : 100 Marks

Time: 01:00 pm-04:00 pm

	SECTION A – K1 (CO1)	
	Answer ALL the questions	**(5 x 1 = 5)**
1	**Fill in the blanks**	
a)	Compound of hydrogen with less electronegative elements are known as_____	
b)	_____ is the smallest fullerene that can be isolated as a stable species.	
c)	Hydrolysis of XeF_4 produces the explosive _____ compound.	
d)	In a radioactive decay, the mass number as well as the atomic number remain unchanged; therefore the decay is _____.	
e)	Isotopes of an element have different number of _____	
	SECTION A – K2 (CO1)	
	Answer ALL the questions	**(5 x 1 = 5)**
2	**Answer the following**	
a)	What are carboranes and how are they classified?	
b)	Draw the structure of P_4O_{10}.	
c)	Mention the geometry of XeF_6.	
d)	*The nucleus of* $^{30}_{15}P$ is unstable. Rationalize.	
e)	Mention the moderators employed in a nuclear reactor.	
	SECTION B – K3 (CO2)	
	Answer any THREE of the following	**(3 x 10 = 30)**
3	Discuss structure and bonding in $C_2B_{10}H_{12}$. Provide any three reactions of $C_2B_{10}H_{12}$.	
4	Classify the metal carbides and explain the structural and bonding characteristics.	
5	Discuss the synthesis and reactivity of S_2F_2 and SF_4.	
6	Illustrate the nuclear shell model and magic numbers for nuclear stability.	
7	Explain the working principle of scintillation counter	
	SECTION C – K4 (CO3)	
	Answer any TWO of the following	**(2 x 12.5 = 25)**
8	(a) Discuss the structure and bonding in B_5H_{11} and $B_{10}H_{14}$ by semi-topological scheme proposed by Lipcomb.	

	(b) Deduce the STYX number for B_5H_{11} and $B_{10}H_{14}$.	(7.5 + 5)
9	Illustrate the composition, structural features, and applications of zeolite.	
10	a) Cite any six applications of xenon and its compounds. b) Outline the synthesis of any four transuranium elements.	(6+6.5)
11	Describe the working principle of a conventional nuclear reactor.	
	SECTION D – K5 (CO4)	
	Answer any ONE of the following	**(1 x 15 = 15)**
12	a) Write a brief note on PSEPT theory and predict the structure of $B_6H_6^{2-}$ and B_5H_9. b) Write a short note on the formation and structural features of pyroxene mineral.	(8+7)
13	a) Describe the Soddy-Fajans group displacement law with suitable examples. b) Differentiate atom bomb from hydrogen bomb.	(7+8)
	SECTION E – K6 (CO5)	
	Answer any ONE of the following	**(1 x 20 = 20)**
14	a) How are molecular hydrides classified? Give their properties with two examples each other. b) Elaborate the structural conformations and π-bonding models of cyclic phosphazenes.	(10+10)
15	a) Discuss the synthesis and chemical characteristics of nitrogen trifluoride. b) Outline the principle involved in determining the age of the Earth. c) Explain the radiolysis of water.	(6+7+7)
